

INTELLIGENT TELEPHONE NUMBER DIALER AND METHOD

Field of the Invention

This invention relates generally to telephone number dialers and, more specifically, to an apparatus and method for automatically transmitting a ten or eleven-digit telephone number following entry by the user of only a three-digit prefix followed by a four-digit suffix of the telephone number.

Background of the Invention

In recent years, various telephone companies have lobbied for more area codes within major metropolitan areas so that today many major cities have two or more telephone area codes. As a result, instead of dialing seven digits as in the past to make a local call, users are now subjected to the inconvenience of dialing ten digits and, in some cases, eleven. Entering telephone numbers into a cellular phone, especially while driving a motor vehicle, has thus become even more dangerous.

Automatic telephone area code dialers are known in the prior art. Exemplary of this art is U.S. Patent No. 5,895,896 to Rosen, directed to a telephone line prefix dialer for automatically transmitting a local area code as a prefix to a call made within the same area code. This prior art device is disadvantageous in that it has the capability of transmitting only a single predetermined area code, thus rendering it useless in today's metropolitan areas encompassing multiple area codes. Moreover, if the user of this device wishes to dial a number within an area code that is outside the single predetermined local area code, he or she must, within a short time following receipt of a dial tone, "flash" the line to inhibit the device from transmitting the predetermined local area code to thereby allow the user to manually enter a different area code. This is

inconvenient and awkward for the user. Another known prior art reference is U.S. Patent No. 5,859,901 to Brendzel et al., directed to an intelligent call connection service that utilizes software and a database residing in a telephone utility central office switching center to automatically transmit an area code prefix to dialed telephone numbers, through analysis of the calling subscriber's calling pattern, taking into account the distance between the calling and called parties. This system relies totally on modification, at tremendous cost, of a telephone utility's central office switching equipment.

It would thus be advantageous to provide a device that would serve to automatically transmit the required area code, based on the telephone number prefix entered by the user, so that the user need then enter only the seven-digit telephone number and, in rare instances, a selection digit in the event the desired prefix is valid in multiple area codes. Such a device could be made to be connectable between an existing telephone and a telephone line outlet to which it is normally connected, could be incorporated into a conventional telephone, or could be incorporated into the telephone utility's central office switching equipment.

Summary of the Invention

As used herein, a ten-digit telephone number is one that includes a three-digit area code, followed by a three-digit prefix, and ending with a four-digit suffix. An eleven-digit telephone number is one that includes the digit one, followed by a three-digit area code, followed by a three-digit prefix, and ending with a four-digit suffix.

The present invention is directed to an apparatus and method for automatically dialing a ten or eleven-digit telephone number following entry by the user of only the three-digit prefix and four-digit suffix of the telephone number. In one embodiment, the

present invention may be a separate device having the ability to decode DTMF tones that is connected between an existing telephone set and a telephone line wall outlet. The device includes a microprocessor for receiving the decoded digits and comparing them to a multiplicity of digits stored therein as telephone number prefixes. Each stored prefix is associated with a particular area code, so that when a telephone number prefix is entered by the user, its associated area code is automatically transmitted before the seven digits representing the prefix and suffix of the telephone number entered by the user are transmitted. A switch within the device allows the telephone line to which the device is connected to be placed off-hook or on-hook. Selection software within the device selects one area code from a multiplicity of area codes associated with an entered three-digit telephone number prefix, based upon the entered four-digit suffix of that telephone number. A visual display device or a voice synthesizer provides an indication to the user that the prefix of the telephone number entered is associated with more than one area code, allowing the user to enter a single digit for the purpose of selecting the desired area code. The data stored in the device may be programmably changed or updated.

The apparatus and method of the present invention, as briefly described in the preceding paragraph, may alternatively be contained within a standard telephone set. In accordance with another alternative, the apparatus and method of the present invention may be incorporated within a cellular telephone. Minimizing the number of digits that must be entered into a cellular telephone by the user when calling improves safety by reducing the amount of time that the user is distracted from operating his or her vehicle. The existing alphanumeric display on today's cellular telephones serves to display the complete ten-digit telephone number after the user has entered the three-digit prefix and

four-digit suffix of that number so that the complete number may be verified before it is transmitted. Also, the display or a voice synthesizer may be employed to present multiple area code selections, and the user then enters a selected area code by actuation a keyboard selection key or by an appropriate selection digit, which is interpreted by conventional voice recognition techniques. In accordance with a third alternative, the method of the present invention may be implemented within a telephone utility's switching center and other telephone utility systems as a software addition to existing user features. Doing so will enhance subscribers' acceptance of the ten or eleven-digit dialing requirement, since in most instances they need enter only seven digits and, in rare cases, a selection digit, when the entered prefix is valid in multiple area codes. Other applications of the present invention include telefax machines, personal computers, modems, etc.

Brief Description of the Drawings

Figure 1 is an overall block diagram of circuitry employed in the intelligent telephone number dialer of the present invention.

Figure 2 is a block diagram of the circuitry of Figure 1 illustrating the addition of a display for allowing the user to view multiple area codes in which a telephone number prefix entered by a user is valid.

Figure 3 is a block diagram of the circuitry of Figure 1 illustrating the addition of a voice synthesizer for audibly indicating multiple area codes in which a telephone number prefix entered by a user is valid.

Figures 4A-E are a flow chart illustrating the steps of the intelligent telephone number dialing method of the present invention.

Detailed Description of the Preferred Embodiment

Referring now to Figure 1, there are shown a conventional telephone instrument 2, a Dual Tone Multiple Frequency (DTMF) decoder 4, a microprocessor 6, a non-volatile memory 8, a telephone line switch block 10, a DTMF transmitter 12, a programming enabler 13, and an incoming telephone line 14. In the embodiment in which the intelligent telephone number dialer of the present invention is incorporated within conventional telephone 2, as opposed to being a separate device connected between conventional telephone 2 and incoming telephone line 14, the DTMF decoder 4 and the DTMF transmitter 12 would not be separately required, since these components form part of conventional telephone 2. In the embodiments in which the present invention is incorporated at a telephone utility's central office or within a cellular telephone, only a software implementation of the method steps of Figures 4A-E is required.

During a loss of power or failure of the circuitry of Figures 1-3, telephone 2 will operate normally. Memory 8 is preprogrammed with all of the three-digit telephone number prefixes and their associated area codes for a given geographical area. The data stored in memory 8 may be conventionally updated by downloading data from an Internet site or over telephone lines.

During operation of the device of Figure 1, the user employs telephone 2 to enter a seven-digit telephone number, which is received by microprocessor 6 through DTMF decoder 4 and temporarily stored in microprocessor 6. When microprocessor 6 determines that the first digit entered is not a one, zero, or nine, and that the first three digits entered match a three-digit telephone number prefix stored in memory 8,

microprocessor 6 enables switch block 10 to disconnect telephone 2 from telephone line 14 and to connect telephone 2 to an internal power supply to allow dialing to continue, while simulating an on-hook condition at telephone line 14. Following a short delay, microprocessor 6 again enables switch block 10 to take telephone line 14 off-hook and switch it to DTMF transmitter 12 for transmitting the area code retrieved from memory 8, followed by the associated three-digit prefix and the four-digit suffix entered by the user. When transmission of the entire ten-digit telephone number is complete, microprocessor 6 again enables switch block 10 to connect telephone line 14 to telephone 2 to allow the user to continue with the call.

In certain geographic areas, the digit one must be entered as the first digit of the telephone number to be called. This is referred to as eleven-digit dialing. In this case, when a prefix entered by the user is detected by microprocessor 6 as one stored in memory 8, the digit one will be transmitted by DTMF transmitter 12 prior to transmitting the associated area code. If the user enters one, nine, or zero as the first digit of a telephone number to be called, or if the first three digits entered are not associated with an area code stored in memory 8, the call will be allowed to go through as entered by the user without any intervention. Programming enabler 13 allows the conventional updating of the database stored in memory 8 by switch activation, an off-hook condition in the absence of an incoming call, or by a specific sequence of digits. In the event the user enters a telephone number prefix that is valid in more than one area code, a display 5 illustrated in Figure 2 is employed to display those area codes, along with an associated selection digit to be entered by the user for selecting a desired one of those area codes. Alternatively, the foregoing area code selection may be accomplished by means of a

voice synthesizer 7, as illustrated in Figure 3, which audibly alerts the user to the multiple area codes along with a digit to be entered to select the desired area code.

Referring now to Figures 4A-E, there is shown a flow chart of software performed by the intelligent telephone number dialer of Figures 1-3. When power is applied to the device, all variables, constants, and routines are initialized at block 18 to allow the device to sense an off-hook or on-hook condition in order to determine the start and finish of each telephone call at a decision block 20. If a call has ended, as indicated by an on-hook condition, then all variables, constants, and routines are reset for the next call at block 22. If a call has started, as indicated by an off-hook condition, then a test is performed at decision block 24 to determine if all digits have been entered by the user. If not, processing continues at point C of Figure 4C. If so, then a loop 26 is entered until all digits have been entered. If a talk flag is set, the telephone is connected to the line without any intervention by the device. The loop 26 continues without interruption until the call has ended, as indicated by an on-hook condition determined at decision block 20. If the talk flag is not set, as determined by loop 26, each entered digit is stored in a temporary memory, in accordance with block 28, and a check is performed at decision block 30 to determine if three digits have been entered. If less than three digits have been entered, processing continues in the main loop beginning at point A. If the first digit entered is zero, then the talk flag is set to prevent intervention by the device. If three or more digits have been entered, processing continues at subroutine B of Figure 4B.

Referring now to Figure 4B, if an area code flag is not set, as determined at decision block 34, processing continues at subroutine D of Figure 4D to retrieve the selected area code, as described hereinbelow. When subroutine D returns from a call

check to determine if the first three digits entered are associated with a valid area code, a negative determination causes an area code flag to be set to invalid, the talk flag to be set at block 38, and processing to continue at main loop A. This condition usually indicates that the user has begun entering a number other than a seven-digit number having a valid prefix, such as a 1XX out-of-area number, a 911 emergency number, or some other invalid prefix number. If the first three digits entered are associated with a valid area code, a determination is made at decision block 44 as to whether the line has been disconnected from the DTMF transmitter following the correct number of program loops. If not, the line is disconnected at block 42. If the area code flag is set, as determined at decision block 34, and the line has been disconnected as the result of the correct number of program loops being performed, a determination is made at decision block 46 as to whether the line has been connected to the DTMF transmitter following the correct number of program loops. If the area code flag is not set, the line is connected at block 48. If the line has been previously connected to the DTMF transmitter following the correct number of program loops, then processing continues at point C of Figure 4C.

Referring now to Figure 4C, the next area code or the next digit stored in memory is sent in the proper sequence by the DTMF transmitter at block 52. If all area code digits and all stored digits have not been sent by the DTMF transmitter, as determined at decision block 54, the processing continues at the main loop beginning at point A of Figure 4A. If all area code digits and all stored digits have been sent by the DTMF transmitter, as determined at decision block 54, the telephone is then reconnected to the line, the talk flag is set to prevent intervention by the device, and processing continues at the main loop beginning at point A of Figure 4A.

Referring now to the subroutine of Figure 4D, the first three digits entered are searched in memory, in accordance with block 60. If the first three digits entered are the symbol sequence *1#, processing continues at point E of Figure 4E. If seven digits have been entered, as determined at decision block 62, the memory is searched at block 68 to determine if a unique area code is associated with the prefix portion of the seven-digit telephone number entered. If a display device is available and more than one area code is associated with the seven-digit number entered, those area codes are displayed, each with an associated selection digit to allow the user to select the desired area code, in accordance with block 66. If a display device is not available, a determination is made at decision block 70 as to whether a voice synthesizer is available. If yes, an audio message to enable the user to select the desired area code is sent to the telephone headset, in accordance with block 72. If neither a voice synthesizer nor a display device is available, the first area code found in memory is selected, in accordance with block 74. If fewer than seven digits have been entered by the user and only one area code is associated with the first three digits entered, the selection digit for that area code is set in accordance with block 68. If a selection digit has been entered by the user, as determined at decision block 76, the area code flag is set, in accordance with block 78, and processing is returned. If a selection digit has not been entered by the user, as determined at decision block 76, the area code flag is not set, and processing is returned.

Referring now to Figure 4E, if memory programming is not enabled, as determined at decision block 81, the talk flag is set, and processing continues at point A of Figure 4A. If memory programming is enabled, data may be received by the device over the telephone line that is representative of telephone number prefixes and their

associated area codes, in accordance with block 82. The received data may include the digit one to indicate an out-of-area telephone number to thereby accommodate eleven-digit dialing when necessary. If a delimiter in the form of the symbol sequence *2# is received, the previously received data is then stored in memory, the talk flag is set, and processing continues at point A of Figure 4A. If a delimiter in the form of the symbol sequence *9# is received, as determined at decision block 86, processing continues at point E for receiving additional data.

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